VERIFICATION OF TRANSLATION

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declare that I am well acquainted with both the Japanese and English languages, and that the attached is a literal translation, to the best of my knowledge and ability, of

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[TITLE OF INVENTION] Processing program edition conferencing method and system

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[Title of the Invention] Processing program edition conferencing method and system

[What is Claimed is]

[Claim 1]

A processing program edition conferencing method that enables an order receiving party that receives a request to manufacture a sheet metal product, to have a virtual examination of the manufacturing work for the sheet metal product using its own computer, said method comprising the steps of:

a computer of the order receiving party prompting a computer of an outsourcing service center to login;

said computer of the outsourcing service center logging in to said computer of the order receiving party; and

said computer of the outsourcing service center logged in, operating said computer of the order receiving party based on instructions related to the processing program edition conference from the order receiving party.

[Claim 2]

The processing program edition conferencing method according to claim 1 wherein said operating of said computer of the order receiving party in connection with said processing program edition conference includes a step of creating a control program for an NC machine tool for producing said sheet metal product.

[Claim 3]

A processing program edition conferencing method

according to claim 1 or 2 wherein said operating of the computer of the order receiving party in connection with the processing program edition conference includes a step of calculating an estimate for the product.

[Claim 4]

A processing program edition conferencing method according to any of claim 1 to 3 further comprising a step of accumulating data obtained by said operating of said computer of the order receiving party in connection with said processing program edition conference, in memory of the computer of the order receiving party.

[Claim 5]

A processing program edition conferencing method according to any of claim 1 to 4 further comprising a step of accumulating data obtained by said operating of said computer of the order receiving party in connection with said processing program edition conference, in memory of the computer of the outsourcing service center.

[Claim 6]

A processing program edition conferencing system that enables an order receiving party that receives a request to manufacture a sheet metal product, to have a virtual examination of the manufacturing work for the sheet metal product using its own computer, said system comprising:

means of a computer of the order receiving party that prompts a computer of an outsourcing service center to login;

means of a computer of the outsourcing service center that

logs in to said computer of the order receiving party; and

means of said computer of the outsourcing service center logged in the computer of the order receiving party that operates said computer of the order receiving party based on instructions related to the processing program edition conference from the order receiving party.

[Detailed Description of the Invention]

[0001]

[Technical Field to Which the Invention Belongs]

The present invention relates to a method and a system for conferencing concerning processes for sheet metal work. More specifically, the present invention relates to a method and a system for a conference between parties compiling and performing processes for sheet metal work, that involves utilizing an outsourcing service that uses IT to perform a virtual simulation of production of a product by remote means, before the product is produced.

[0002]

[Prior Art]

Generally, outsourcing business for sheet metal firms doing sheet metal work, such as the work of operating CAD/CAM systems provided by the sheet metal firms themselves, involves dispatching operating staff to that customer, with those staff utilizing the resources, such as computers, of that customer. This is a manpower dispatching type outsourcing business.

[0003]

On the other hand, outsourcing services for work to be

performed by a party receiving an order to perform work based on electronic data of drawings from the party ordering the work (the ordering customer), such as making an estimate, producing development drawings, producing a program for a process or the like, or even making proposals when results of such work are submitted, are often performed at an outsourcing service center via the Internet for example.

[0004]

[Problems to be Solved by the Invention]

Such conventional outsourcing service has the following problems.

[0005]

An issue facing such a party receiving an order to perform work is that a programmer is too pressed for time and therefore the company president, factory manager, an experienced sheet metal bending engineer and a programmer are almost impossible to have a conference together on the side of the party receiving an order, concerning the edition of the processes required to perform the sheet metal work.

[0006]

Further, an issue facing those on the side of the outsourcing service center, is that when they wish to conference on the processing program edition using CAD/CAM equipment of their customer (the party receiving the order i.e. the order receiving party), a problem arises due to being separated by physical distance. Moreover, when, due to a product deadline for example, the processing program edition conference must be

performed swiftly, time constraints can be challenging.

[0007]

[Means for Solving the Problems]

With such problems in view, the present invention proposes a processing program edition conferencing method that enables an order receiving party that receives a request to manufacture a sheet metal product, to have virtual examination of the manufacturing work for that sheet metal product using its own computer, which method preferably comprises the steps of:

a computer of the order receiving party prompting a computer of an outsourcing service center to login ;

the computer of the outsourcing service center logging in to the computer of the order receiving party; and

the computer of the outsourcing service center logged in , operating the computer of the order receiving party based on instructions related to the processing program edition conference from the order receiving party.

[0008]

Further, it is preferable that the operation of the computer of the order receiving party in connection with the processing program edition conference includes a step of creating a control program for a NC machine tool for producing the sheet metal product.

[0009]

It is preferable that the operation of the computer of the order receiving party in connection with the processing

program edition conference includes a step of calculating an estimate for the product.

[0010]

It is preferable to include a step of accumulating data obtained by the operation of the computer of the order receiving party in connection with the processing program edition conference, in memory of the computer of the order receiving party.

[0011]

Further, it is preferable to include a step of accumulating data obtained by the operation of the computer of the order receiving party in connection with the processing program edition conference, in memory of the computer of the outsourcing service center.

[0012]

Again, the present invention proposes a processing program edition conferencing system that enables an order receiving party that receives a request to manufacture a sheet metal product, to have a virtual examination of the manufacturing work for the sheet metal product using its own computer, which system preferably include:

means of a computer of the order receiving party that prompts a computer of an outsourcing service center to login;

means of a computer of the outsourcing service center for logging in to the computer of the order receiving party; and

means of the computer of the outsourcing service center logged in that operates the computer of the order receiving

party based on instructions related to the processing program edition conference from the order receiving party.

[0013]

[Mode for Carrying out the Invention]

An embodiment of the present invention will now be described with reference to the drawings. FIGS. 1 to 3 schematically depict a processing program edition conferencing system 1 related to this embodiment.

[0014]

As shown in FIG. 1, this example describes a case of a sheet metal work contracting factory carrying out processes related to sheet metal products. Further, the processing program edition conference of this example includes performing a work outsourced from an order receiving party 5 using a computer 13 of an outsourcing service center that logs into a computer 11 of the order receiving party, the work including virtual product design, NC data creation, production of an estimate prior to receiving a formal production order or the like before actual production of the sheet metal product.

[0015]

The processing program edition conferencing system 1 comprises an originator of an order 3, (hereinafter "ordering customer 3") that issues a request about production of a sheet metal product, the order receiving party 5 that accepts the request from the ordering customer 3 about producing the sheet metal product and an outsourcing service center 7 that subcontracts to perform part of the work of the order receiving

party 5.

[0016]

The ordering customer 3 has their computer, the computer 9 of the ordering customer, the order receiving party 5 has their computer, the computer 11 of the order receiving party, and the outsourcing service center has their computer, the computer 13 of the outsourcing service center.

[0017]

The computer 9 of the ordering customer, computer 11 of the order receiving party and computer 13 of the outsourcing service center are able to communicate via a communications system 15 such as the Internet or the like.

[0018]

A characteristic of the processing program edition conferencing system 1 of this example is that the outsourcing service center 7 can log into the computer 11 of the order receiving party so that the logged in computer 11 can be operated in accordance with instructions of the order receiving party 5, virtually performing a variety of services such as creating a processing program or preparing a pre-order estimate, prior to actual sheet metal product manufacturing work performed by the order receiving party 5. This arrangement enables a bringing together of the know how concerning high-level CAD/CAM systems of the outsourcing service center 7 and the know how on creating a product on the side of the order receiving party 5.

[0019]

Further, participants in the processing program edition conference at the order receiving party 5 (for example, the president of the firm, the factory manager, an experienced sheet metal working engineer) are in a state that they can convey and exchange information with a CAD/CAM operator of the outsourcing service center 7. For example, the participants and CAD/CAM operator are in a state that they can convey their respective thoughts to each other using audio information (for example, using mobile telephones). This enables both sides in the arrangement to mutually perform the required work together. That is to say, the arrangement works such that it is just as if the outsourcing service center 7A is being provided directly to the order receiving party 5 (a brainpower dispatch type outsourcing).

[0020]

As shown in FIG. 2, another characteristic of the processing program edition conferencing system 1 of this example is that a CAD/CAM system of the computer 11 of the order receiving party can be remotely controlled using a remote control tool (for example, pcAnyhere), so that NC data can be created for a NC machine tool (such as a laser processing machine, NC turret punch press or bending machine or the like) from product drawings. This enables the various functions of the CAD/CAM system to be utilized to the maximum, given that it is very difficult for an ordinary user to become proficient at using all the functions.

[0021]

A detailed description of this processing program edition conferencing system 1 will now be described with reference to FIG. 3. As outlined above, the processing program edition conferencing system 1 includes a computer 9 of the ordering customer, a computer 11 of the order receiving party and a computer 13 of the outsourcing service center.

[0022]

The computer 9 of the ordering customer comprises a CAD/CAM system 17, a CAD/CAM part 19 that performs CAD/CAM operations, a CAD/CAM data memory 23 that stores CAD/CAM data, and a screen 21 that displays CAD drawings and the like. Moreover, CAD/CAM data for the sheet metal product production of which is the subject of the request, is transmitted to the computer 11 of the order receiving party by a transmission part 25.

[0023]

The computer 11 of the order receiving party comprises a remote control tool 27 that enables remote control from the computer 13 of the outsourcing service center, a CAD/CAM system 29, a receiving part 31 for receiving CAD/CAM data transmitted from the computer 9 of the ordering customer, a CAD/CAM part 33, a edition/editing part 35 for reading in CAD/CAM data and producing process data or estimate data, a linking part 37 for linking between the CAD/CAM part 33 and the edition part 35, a screen 39, and a transmission part 41 for storing the process data and estimate data in a database 50 and transmitting that data to the prescribed memory. Moving/dynamic images on screen,

remotely controlled and displayed thereon, are accumulated in the database 50, thus enabling the order receiving party 5 to accumulate sheet metal production know how.

[0024]

CAD/CAM data is stored in a CAD/CAM data memory 43. Data required for calculating the processing time required and processing expenses is stored in a process related reference table 45. NC data for a NC machine is housed in a process data memory 47. Estimate related data including data for price estimates and production delivery schedules and the like is stored in an estimate data memory 49.

[0025]

The computer 13 of the outsourcing service center comprises a remote control tool 51 that enables display of the same image as that displayed on the screen of the computer 11 of the order receiving party, a screen data reception part 53 for receiving data for the image being displayed on the screen (screen data) of the computer 11 of the order receiving party, and a display/accumulation part 57 that displays an image from the screen data on a screen 55 and has a function for accumulating data related to that screen data.

[0026]

Screen data received is stored in a screen data memory 59 and data related to screen data is stored in an accumulated data memory 61. Thus, a broad range of the know how of the order receiving party 5 on sheet metal manufacturing work is accumulated in the computer 7 of the outsourcing service center.

[0027]

The operations of the processing program edition conferencing system 1 will now be described with reference to FIGS. 4 to 22.

[0028]

As shown in FIG. 4, in step S401 the ordering customer 3 makes a product production request (including an estimate) to the order receiving party 5. At this time, the ordering customer 3 also transmits electronic drawings such as a trihedral figure of the product and the like.

[0029]

In step S403, the order receiving party 5 confirms the product production request and receives the trihedral figure of the product in the electronic drawings, and moreover, the order receiving party 5 issues a request for services to the outsourcing service center 7.

[0030]

In step S405, the outsourcing service center 7 performs the services based on the request therefor issued by the order receiving party 5.

[0031]

In step S407, the computer 13 of the outsourcing service center logs into the computer 11 of the order receiving party and the computer 11 of the order receiving party is operated in accordance with instructions issued at the side of the order receiving party 5. This arrangement enables a processing program edition conference occurring within the sphere of the

order receiving party 5.

[0032]

A more detailed explanation of the operations of this processing program edition conferencing system 1 will now be described with reference to FIGS. 5 to 20.

[0033]

The following processes, shown in FIG. 5, are performed by the CAD/CAM part 33 (that is linked to the edition part 35), remotely controlled from the computer 13 of the outsourcing service center; this remotely controlled operation being performed based on instructions issued from the order receiving party 5. These processes include operations to create a control program for a NC machine tool and to produce an estimate.

[0034]

In step S501, the order receiving party 5 takes transfer from the ordering customer 3, of a paper drawing providing drafts of the product, electronic drawing of the product created by CAD, three-dimensional CAD data modeling the product using three-dimensional CAD, or the like, and receives a request to produce an estimate.

[0035]

FIG.6 shows the kinds of drawings which the order receiving party 5 receives from the ordering customer 3. That is to say, the order receiving party 5 may receive a paper trihedral figure drawing 601, an electronic drawings 603 or a 3-D model 605. The successive processes differ according to the type of drawing received. Namely, if the order receiving

party 5 receives a paper trihedral figure drawing 601, the next step is step S503. If an electronic drawing 603 is received, the next step is step S505 and if the order receiving party 5 receives a 3-D model, the next step is step S507.

[0036]

In step S503, the drawing received is a paper trihedral figure drawing 601 so CAD drawings are produced with reference to this paper trihedral figure drawing 601.

[0037]

In step S505, a solid figure drawing that is a three-dimensional solid figure form is produced from a two-dimensional CAD drawing.

[0038]

The method for producing a three-dimensional, solid figure drawing from a two-dimensional CAD graphic form will now be described in outline.

[0039]

As shown in FIG. 6, elements that are unnecessary for the creation of a solid figure drawing such as dimension lines, auxiliary lines, framing, reference figures and sheet thickness lines and the like are removed from the electronic trihedral FIG. This results in display of a screen 609 comprising a front view 611, a side view 613 and a top view 615. The front view 611, side view 613 and top view 615 are correlated with each other in view of the bending positions. The solid figure drawing is produced by adding data for sheet thickness and like to the connected views and is then displayed on a display 617.

[0040]

In step S507, the positions for disassembly of the product are indicated on the solid figure drawing, and a breakdown of the assembled components figure, the work of dividing the product up into a plurality of components, is performed. The breakdown of the assembled components figure is performed in accordance with instructions from the members participating in the processing program edition conference, i.e. the president, factory manager and an experienced sheet metal bending engineer.

[0041]

The work of dividing the product into a plurality of components, will now be described with reference to FIG. 7. The solid figure drawing created in step S505 is displayed on a screen 701. On this screen, referring to the solid figure drawing, the appearance is considered as well as interference and workability when the product is broken down into a plurality of the components thereof. For example, the product is to be broken down into a component 701a and a component 701b with regard for costs of assembling the product, or the product is to be broken down into a component 701c, a component 701d, a component 701e and a component 701f with regard for the method of processing the product.

[0042]

The results for VE and VA according to the workability and processing method as considered here are stored in the database 50 as text data.

[0043]

Further, on screen 703 a check is performed to ascertain any interference between components that may arise when a breakdown of the assembled components figure is performed. The VE and VA results for processing viability as considered here are stored in the database 50 as text data.

[0044]

Moreover, confirmation of how the product is to be broken down into its components is performed at screen 705. A solid figure for each of the broken down components is displayed on the screen 707. In this way, a development drawing can be created for each component.

[0045]

In step S509, a development drawing is created for each of the plurality of components into which the product is broken down.

[0046]

The method of creating a development drawing 801 will now be described with reference to FIG. 8. A solid figure drawing of a separated component is displayed on a screen 803. Next, a development drawing 101 is created from the solid figure drawing of this component. Here, an envisaged value of the extension from bending is regarded when a bending portion is developed. For example, a table 807 stored in the process related reference table 45 is referred when bending portion 805 is developed. This table 807 includes a sheet thickness field 807a and a bend extension value field 807b. The bend (bending)

extension values for each company are set in the bend extension field 807b (company A 807c, company B 807d and company C 807e). That is to say, where the ordering party 3 is company A 807c, when the product uses material of sheet thickness 1, the bend extension is set at 1.5 if a bend is required. Accordingly, development drawing 801 is produced having dimensions in which the value for the fold extension is compensated for (subtracted).

[0047]

The area calculation 809 is performed from the development drawing 801. Table 812 stored in the process related reference table 45 is then referred to perform materials expenses calculation 811. In this table 812, unit prices for a plurality of materials 815 (e.g. SPCC, SPHC, SUS) corresponding to each sheet thickness 813 are registered in the price fields 817. The materials expenses data is stored in memory.

[0048]

Further, the blank processing time and blank processing expenses are calculated by reference to the development drawing.

[0049]

The method for calculating the blank processing time and blank processing expenses will now be described with reference to FIG. 9. The data for the development drawing 901 is read in from a CAD/CAM data file 43 in which the development drawing 901 is stored. The blank processing can be performed by

processing with a turret punch press or a laser processor.

[0050]

The processing expenses where processing is performed using a turret punch press is the value obtained by multiplying the blank processing expense 903 for processing the form developed by the number of sheets for processing 905, then adding turret punch press setup expenses 907. The blank processing expenses 903 include the following processing expenses.

[0051]

That is to say, shearing process expenses 903a, turret punch press processing expenses 903b, tapping processing expenses 903c and deburring processing expenses 903d.

[0052]

The processing expenses where processing is performed using a laser processor is the value obtained by multiplying the blank processing expenses 909 for processing the form developed by the number of sheets for processing 911. The blank processing expenses 909 include the following processing expenses.

[0053]

That is to say, shearing process expenses 909a, laser processing expenses 909b, tapping processing expenses 909c and deburring processing expenses 909d.

[0054]

The calculating method of the processing expenses for each of the above described processing machines is described

below. For shearing process, the rectangular area of the blank material 913a is multiplied by a standard unit price for cutting 913b (unit area).

[0055]

The a standard unit price is described with reference to FIG. 10. In table 1001, material fields 1001b (e.g. SPCC, SPHC, SUS) are arranged corresponding to a plurality of sheet thickness fields 1001a. Unit price fields 1001c are arranged to correspond to the respective materials and different sheet thicknesses and a unit price is set in each field. The table 1001 is stored in the process related reference table 45 as a shearing process unit price master.

[0056]

In the case of turret punch process, the value of multiplying the processing time by form processed 915a (calculated from NC data) by a standard unit price for turret punch press work 913b (for a time unit) is calculated. This calculation is performed for all processed forms and the total, that is for the total of all the forms developed for parts arranged on one sheet, is then calculated.

[0057]

Regarding to setup expenses, the time required for changing dies is calculated by multiplying the number of dies to be used 917a by the time required for changing dies of different sizes 917b to. The time required for changing dies is multiplied by a unit price (for a time unit).

[0058]

More spec description is provided with reference to the FIG. 11. The development drawing 1101 is read in and a decision is made that turret punch presses will be performed. A process data 1103 is allocated to the development drawing 1101. Based on the die process data 1103, the number of punches 1105d for the die shape 1105a, pattern 1105b and the die size 1105c is counted and stored. The time required for changing dies set in the time field 1107b corresponding to the die size 1107a as the setup time calculation master 1107, which is stored in the process related reference table 45, is read in to calculate the total setup time for the dies to be used. This total time is multiplied by a unit price to calculate turret punch press setup expenses 907.

[0059]

For calculating processing expenses, a CG simulation is performed referring to the operating speed calculation table 1109, the punch time calculation table 1111, the turret turnaround time calculation table 1113, the processor/dies used/processing method/material property master 1115 and the processing time calculation master 1117 stored in the process related reference table 45 so as to calculate the processing time 1119. Referring to the processing expenses calculation table 1121 using the processing time 1119, turret punch press processing expenses 1123 are calculated. The processing expenses calculation table 1121 includes a processing type field 1121a, (e.g. turret punch press processing, laser processing or tapping processing) and a monetary amount field

1121b, having amounts corresponding to the processing type.

[0060]

In the case of laser processing, different forms processed 919a is multiplied by a standard unit price for laser processing work 919b (for a time unit). This calculation is performed for all processed forms and the total is then calculated.

[0061]

Calculating method for laser processing expenses 909b will now be described in detail with reference to FIG. 12. Firstly the development drawing 1201 is read in and a decision made that the processing method will be laser processing. A process trajectory 1203 is then set. The form processed 1205a (e.g. the external form, holes), pattern (e.g. a piercing, corner R or straight line) and trajectory length 1205c are extracted from the processing trajectory 1203 while being correlated with each other. Then, a CG simulation is performed referring to the shaft operating speed calculation table 1207, the laser processing time by sheet thickness and materials calculation table 1209, the processing machine/laser cutting conditions/processing method/material property master 1211 and the processing time calculation master 1215 stored in the process related reference table 45 so as to perform a processing time calculation 1215. The laser processing time by sheet thickness and materials calculation table 1209 includes a material field 1209a, in which materials are set, a sheet thickness field 1209b, in which the thickness of a sheet is set,

a pattern field 1209c, in which the pattern is set and a time field 1209d, in which the time used for processing is set. Thus, a processing time unit can be specified for each material, sheet sickness and pattern (e.g. piercing, corner R or straight line).

[0062]

After processing time 1217 is obtained, the processing expenses (for a time unit) calculation table 1219 stored in the process related reference table 45 is referred to calculate the laser processing expenses 1221. The processing expenses (for a time unit) calculation table 1219 includes a processing type field 1219a, in which the type of process to be performed (such as turret punch press, laser processing, tapping processing) is set, and a field 1219b, in which a unit price corresponding to each of these types of processing is set. Thus, the unit price for each process can be obtained.

[0063]

In the case of tapping processing, the value of multiplying the processing time for different tapping hole diameters 921a by a standard unit price for tapping 923b (for a time unit) is calculated. This calculation is performed for the number of times in accordance with the number of tapping holes and the total is then calculated.

[0064]

Referring to FIG. 13, it is described in more detail. Development drawing 1301 is read in and a decision is made that the processor is a tapping processor. Tapping instruction drawing 1303 showing the locations at which the tapping process

is to be performed is then produced. The diameter of the tapping 1305a (e.g. M3, M4, M6) and the corresponding number of holes 1305b is extracted from this tapping instruction drawing 1303. Then, a CG simulation is performed referring to the shaft operating speed calculation table 1307, the processing time by sheet thickness calculation table 1309, the processing machine/processing method/material property master 1311 and the processing time calculation master 1313 stored in the process related reference table 45 so as to perform a processing time calculation 1315, and processing time 1317 is calculated. The processing time by sheet thickness calculation table 1309 includes a sheet thickness field 1309a that establishes the thickness of a sheet, a hole diameter field 1309b, in which the hole diameter (e.g. M3, M4, M5) in relation to each sheet is set, and a processing time field 1309c, in which the processing time in relation to each hole diameter is set.

[0065]

The processing time 1317 is read in, and referring to the processing expenses (for a time unit) calculation table 1319, tapping processing expenses 1321 are calculated. The processing expenses (for a time unit) calculation table 1319 includes a processing type field 1319a, in which the type of process to be performed (such as turret punch press, laser processing, tapping processing) is set, and a monetary amount field 1319b, in which a unit price corresponding to the type of processing is set.

[0066]

In the case of deburring, the value of multiplying processing time by form processed 923a by a standard unit price for deburring 923b (for a time unit) is calculated. This calculation is performed in respect of all forms processed and the sum total is calculated.

[0067]

Referring to FIG. 14, it is described in more detail. The development drawing 1401 is read in and the processor is decided. Then a processing trajectory layout diagram 1403 is produced from the development drawing 1401. The processing trajectory 1405 is extracted from the processing trajectory layout diagram 1403. Then, a CG simulation is performed referring to the shaft operating speed calculation table 1407, the processing time by sheet thickness calculation table 1409, the processing machine/processing method/material property master 1411 and the processing time calculation master 1415 stored in the process related reference table 45 so as to perform a processing time calculation 1415 and processing time 1417 is calculated. The processing time by sheet thickness calculation table 1409 includes a sheet thickness field 1409a, in which the thickness of a sheet is set, and a time field, in which the time used for processing in relation to the thickness is set.

[0068]

Referring to a processing expenses (for a time unit) calculation table 1419 using the processing time 1417, the deburring process expenses 1421 are calculated. The processing expenses (for a time unit) calculation table 1419

includes a processing type field 1419a, in which the type of process to be performed (such as turret punch press, laser processing, tapping processing and deburring processing) is set, and a monetary amount field 1419b, in which an amount corresponding to each type of processing is set.

[0069]

Verification of a prototype is performed in step S511.

[0070]

This prototype verification will now be described in detail with reference to FIG. 15. The prototype verification involves performing prototype verification 1503 to consider what dies should be used and what kind of processes should be used for the bending operations for the development drawing 1501, and the like. The results are stored as text data in the database 50 as VA/VE results in view of processing viability 1503a and VA/VE results in view of workability and processing method 1503b.

[0071]

The bending process expenses are calculated by multiplying the bending process expenses 1505 for each development drawing by the number of sheets processed 1507 and then adding bending set up expenses 1509, and where purchase of a special die is required, expenses for purchase of a special die 1511.

[0072]

More specifically, to obtain the bending process expenses 1505, the processing time by bend form (bending shape) 1513a

is multiplied by a standard unit price for bending (for a time unit) 1513b. This calculation is performed in respect of all bending portions included in the development drawing to calculate the sum total. As a bending set up expenses 1509, the value is obtained by multiplying the number of dies to be used 1515a by the time required for changing dies (unit price).

[0073]

The method for calculating bending process expenses in relation to a development drawing will now be described in detail with reference to FIG. 16. Development drawing 1601 is read in to perform prototype verification 1603. Bending process 1605a, die shape 1605b, bending length 1605c, bending angle 1605d and the like are read in from the development drawing verified by prototype verification. Then, a CG simulation is performed referring to the bending time calculation table 1607, work handling time (for a unit of bending length) calculation table 1609, processing machine/dies to be used/processing method/material property master 1611 and processing time calculation master 1613 stored in the process related reference table 45 so as to perform processing time calculation 1615. This results in calculation of processing time 1617. The bending time calculation table 1607 includes a pattern field 1607a, in which the pattern is set, and a time field 1607b, in which the processing time for each fold pattern is set. The work handling time (for a unit of bending length) calculation table 1609 includes a sheet thickness field 1609a, in which the sheet thickness is set, and a time field, in which the processing

time for each sheet thickness is set.

[0074]

The processing time 1617 is read in, and referring to the processing expenses (for a time unit) table 1619 stored in the process related reference table 45, bending processing expenses 1621 are calculated. The processing expenses (for a time unit) table 1619 includes a processing field 1619a, in which the processing method (e.g. bender) is set and a monetary amount field 1619b, in which the required monetary amount is set.

[0075]

The steps for calculating expenses for a special die will now be described in detail with reference to FIG. 17. Development drawing 1701 is read in to perform prototype verification 1703. As a result, it may be determined that the die, which the order receiving party 5 holds, substantially interferes in the component. In this situation, a form of special die is decided and an order for a die estimate 1709 is issued to a die making firm. The production expenses estimate for the die of special specifications 1711 presented here, serves as the special die expenses.

[0076]

The processes of the step S509 and S511 described above are performed in respect of all components into which the product is broken down.

[0077]

In step S513, verification from an assembled components drawing is performed. This verification enables welding

expenses, coating expenses and expenses for assembling components to be calculated.

[0078]

The method for calculating welding expenses, coating expenses and components assembly expenses will now be described with reference to FIG. 18.

[0079]

The welding process expenses are calculated by multiplying the welding line length 1801a by a standard unit price for welding 1801b (for a unit of length). That is to say, the solid figure drawing 1803 of the product broken down into a plurality of components is read in, welding faces are specified and calculation of welding length 1805 is performed. Here, a coefficient representing the degree of difficulty is added to each weld location. Then, referring to the process time (for a unit of length) table 1807, the welding time 1809 is calculated. The process time (for a unit of length) table 1807 includes a pattern field 1807a, in which the type of welding (e.g. YAG, spot, TIG) is set, and a time field 1807b, in which the time required for welding according to the unit length of each pattern is set.

[0080]

Then the welding time 1809 is read in, and referring to the process expenses (for a time unit) table 1811 and processing machine/processing method master 1813, welding expenses 1815 are calculated. The process expenses table 1811 includes a process field 1811a, in which the type of welding (e.g. YAG,

spot, TIG) is set, and a monetary amount field 1811b, in which the monetary amount required for welding according to the time unit concerned is set.

[0081]

Coating expenses are calculated by multiplying the blank surface area 1817a by a standard unit price (for a unit of area) for different coatings.

[0082]

That is to say, a solid figure drawing of the product broken down into a plurality of components is read in and instructions on coating faces 1819 is made for the solid figure drawing. Then referring to the processing time (for a unit of area) table 1821, the coating time 1823 is calculated. The processing time (area units) table 1821 includes a pattern field 1821a, in which the pattern of the process performed (e.g. preparation, coating, drying) is set, and a time field 1821b, in which the time for each unit of area required to undergo the process of each pattern is set.

[0083]

The coating time 1823 is read in and referring to the processing expenses (for a time unit) table 1825 and processing machine/processing method master 1827, coating expenses 1829 are calculated. The processing expenses (for a time unit) table 1825 includes a process field 1825a, in which the type of process (e.g. preparation, coating, drying) is set, and a monetary amount field 1825b, in which a monetary amount for each unit of time required for each process is set.

[0084]

Assembling expenses are obtained by multiplying the number of components assembled 1831a by a standard unit price (number of units) for assembling 1831b.

[0085]

If there are any problematic issues during verification from an assembled components drawing, operations revert back to step S507 and a re-consideration including breakdown of the assembled components figure is performed.

[0086]

In step S515, a production schedule is considered and an estimated delivery schedule is calculated.

[0087]

FIG. 19 shows the method for deciding the delivery schedule. For example, if the processing steps for producing the product include a programming process 1901, turret punch press/laser process 1903, a bending process 1905, a welding process 1907, a coating process 1909 and an assembling process 1911, in the programming process 1901, process for the current orders now at the estimate stage 1901b will be incorporated after process for the received order 1901a.

[0088]

In the turret punch press/laser process 1903, process for the current estimated orders 1903b is incorporated after process for the received order 1903a. In the bending process 1905, process for the current estimated orders 1905b is incorporated after process for the received order 1905a.

[0089]

In the welding process 1907, process for the current estimated orders 1907b is incorporated after process for the received order 1907a. In the assembling process 1911, process for the current estimated orders 1911b is incorporated after process for the received order 1911a. Thus, delivery dates are decided.

[0090]

The estimates are presented to the ordering customer 3.

[0091]

In step S517, using collaboration tools, the ordering customer 3 and the order receiving party 5 are able to share the solid figure drawings that have been designed by the order receiving party 5 to consider the proposal of VA/VE and description of the design.

[0092]

A processing program (NC data) is created at the same time as the estimates described above are calculated. Accordingly, a processing program is produced by the time that the estimates are calculated. Thus, the processing work can be started immediately when the ordering customer 3 sends out instructions to produce the product.

[0093]

FIG. 20 shows another method of using the processing program edition conferencing system 1 of this example.

[0094]

Here, when the outsourcing center produces NC data for

an order receiving party A for a plurality of NC machine tools (NC processors) to produce a product, the processing know how of that order receiving party can be accumulated in the database 61 of the computer of the outsourcing service center. By referring to examples, the outsourcing service center can provide appropriate CAD/CAM systems for an order receiving party B and an order receiving party C.

[0095]

While the preferred embodiment of the present invention is shown and described herein, it is to be understood that the present invention is not limited to the above described embodiment, the invention can be put into practice in other configuration suitably modified.

[0096]

[Effect of the Invention]

As described, according to this embodiment, by utilizing IT, outsourced services can be performed from a location physically separated by some distance (a computer of an outsourcing service center), by remote operation of a computer of a customer (an order receiving party), rather than performing those outsourced services at the location of the customer. Accordingly, this has the effect that outsourcing services can be speedily provided to fulfill the work for an order receiving party customer, such as making an estimate, producing a development drawing, creating a processing program or the like. Further, as the description of work performed through the outsourced service can be stored in the memory of the computers

of the outsourcing service center and the customer, this has the effect of enabling both of those parties to accumulate know how.

[Brief Description of the Drawings]

[FIG. 1]

FIG. 1 is a schematic view of a processing program edition conferencing system.

[FIG. 2]

FIG. 2 is a schematic view of a processing program edition conferencing system.

[FIG. 3]

FIG. 3 is a schematic view of a processing program edition conferencing system.

[FIG. 4]

FIG. 4 is a flowchart showing the operations of the processing program edition conferencing system.

[FIG. 5]

FIG. 5 is a flowchart showing the operations of the processing program edition conferencing system.

[FIG. 6]

FIG. 6 is an explanatory drawing of a method for making a solid figure drawing from a trihedral figure.

[FIG. 7]

FIG. 7 is an explanatory drawing of a method for disassembling components of a solid figure drawing.

[FIG. 8]

FIG. 8 is an explanatory drawing on calculation of

materials expenses.

[FIG. 9]

FIG. 9 is an explanatory drawing on calculation of expenses for blank processing work.

[FIG. 10]

FIG. 10 is an explanatory drawing on preparation of an estimate for the cost of shearing processes.

[FIG. 11]

FIG. 11 is an explanatory drawing on calculation of expenses for turret punch press processing work.

[FIG. 12]

FIG. 12 is an explanatory drawing on calculation of expenses for laser processing work.

[FIG. 13]

FIG. 13 is an explanatory drawing on calculation of expenses for tapping processing work.

[FIG. 14]

FIG. 14 is an explanatory drawing on calculation of expenses for deburring processing work.

[FIG. 15]

FIG. 15 is an explanatory drawing on calculation of expenses for bending processing work.

[FIG. 16]

FIG. 16 is an explanatory drawing on calculation of expenses for bending processing work.

[FIG. 17]

FIG. 17 is an explanatory drawing on calculation of

expenses for bending processing work.

[FIG. 18]

FIG. 18 is an explanatory drawing on calculation of expenses for welding, coating and assembly work.

[FIG. 19]

FIG. 19 is an explanatory drawing on calculating a delivery schedule.

[FIG. 20]

FIG. 20 is an explanatory drawing depicting accumulation of information.

[Explanation of the Reference Numerals]

1 processing program edition conferencing system

3 ordering customer

5 order receiving party

7 outsourcing service center

9 computer of ordering customer

11 computer of order receiving party

13 computer of outsourcing service center

15 communications system

[Name of Document] Abstract

[Abstract]

[Object] An order receiving party 5 that receives a request from an ordering customer 3 to manufacture a product performs a process edition conference via an outsourcing service using a computer 11 of the order receiving party.

[Solving Means] The order receiving party 5 receives a request from an ordering customer 3 to manufacture a sheet metal product. For manufacturing the product, the order receiving party 5 performs a processing program edition conference to decide the method for processing the product and to estimate the price required and the delivery schedule. In the performance of the processing program edition conference, the order receiving party 5 requests an outsourcing service center 7 for a service. A CAD/CAM operator of the outsourcing service center 7 logs in to a computer 11 of the order receiving party from a computer 13 of the outsourcing service center to participate in the processing program edition conference order receiving party, then decides the processing method, price estimate and delivery schedule on the computer 11 of the order receiving party while operating the computer 11 of the order receiving party.

[Selected Figure] Fig. 1

FIG.1

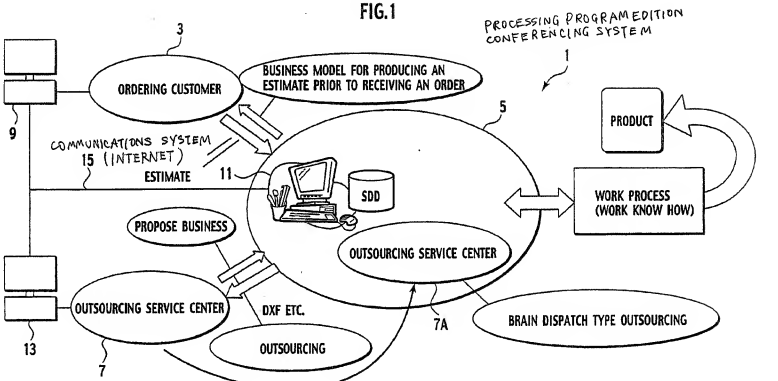
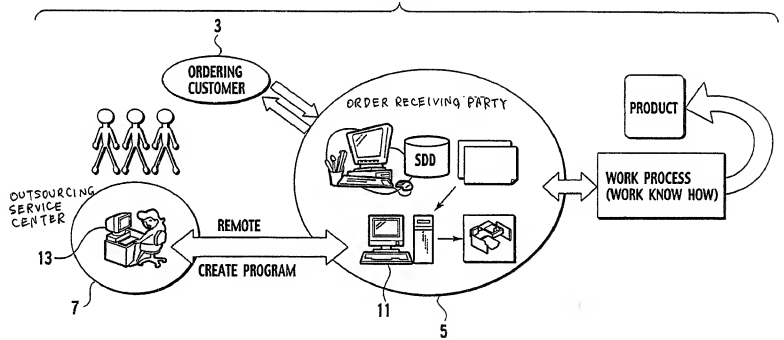

PROCESSING PROGRAM EDITION CONFERENCING SYSTEM
1
3
ORDERING CUSTOMER
BUSINESS MODEL FOR PRODUCING AN ESTIMATE PRIOR TO RECEIVING AN ORDER
5
PRODUCT
9
COMMUNICATIONS SYSTEM
15 (INTERNET)
ESTIMATE
11
SDD
WORK PROCESS (WORK KNOW HOW)
PROPOSE BUSINESS
OUTSOURCING SERVICE CENTER
OUTSOURCING SERVICE CENTER
DXF ETC.
7A
BRAIN DISPATCH TYPE OUTSOURCING
13
7
OUTSOURCING

FIG.2


3
ORDERING CUSTOMER
ORDER RECEIVING PARTY
SDD
PRODUCT
WORK PROCESS (WORK KNOW HOW)
OUTSOURCING SERVICE CENTER
REMOTE
CREATE PROGRAM
13
7
11
5

PROCESSING PROGRAM EDITION CONFERENCING SYSTEM

FIG.3

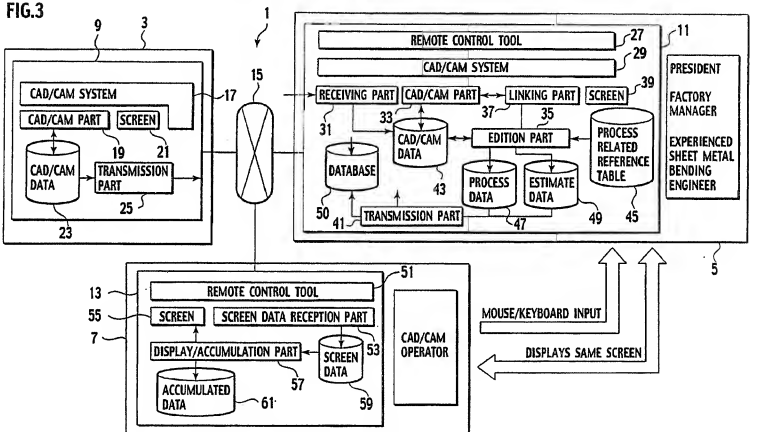


FIG.4

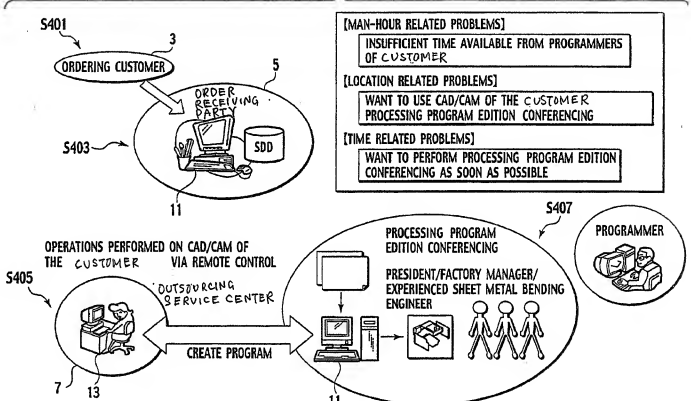
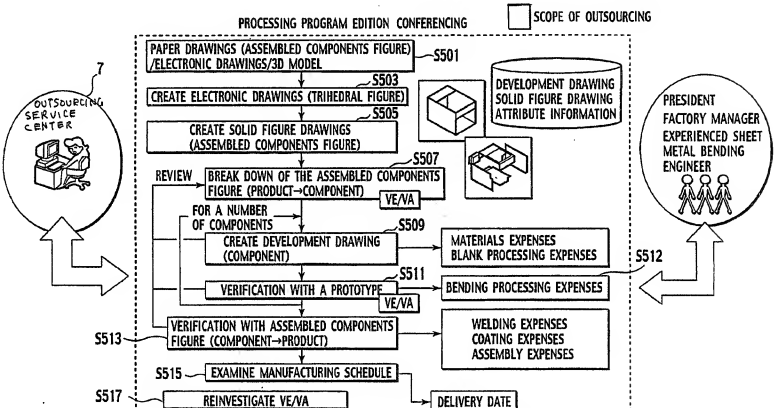
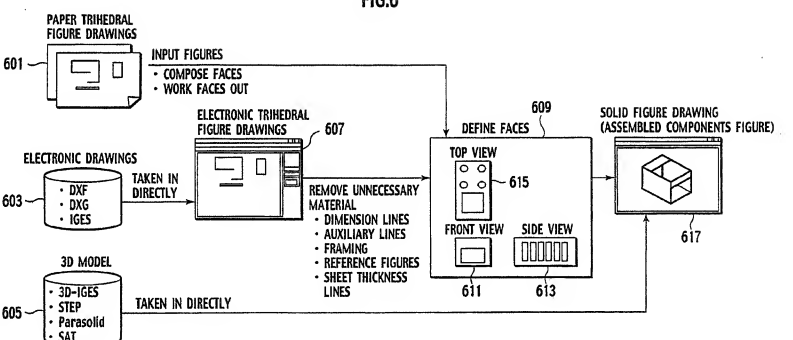

S401
3
ORDERING CUSTOMER
5
ORDER RECEIVING PARTY
S403
SDD
11
[MAN-HOUR RELATED PROBLEMS]
INSUFFICIENT TIME AVAILABLE FROM PROGRAMMERS OF CUSTOMER
[LOCATION RELATED PROBLEMS]
WANT TO USE CAD/CAM OF THE CUSTOMER PROCESSING PROGRAM EDITION CONFERENCING
[TIME RELATED PROBLEMS]
WANT TO PERFORM PROCESSING PROGRAM EDITION CONFERENCING AS SOON AS POSSIBLE
S407
PROGRAMMER
PROCESSING PROGRAM EDITION CONFERENCING
PRESIDENT/FACTORY MANAGER/ EXPERIENCED SHEET METAL BENDING ENGINEER
OPERATIONS PERFORMED ON CAD/CAM OF THE CUSTOMER VIA REMOTE CONTROL
S405
OUTSOURCING SERVICE CENTER
CREATE PROGRAM
7
13
11

FIG.5


PROCESSING PROGRAM EDITION CONFERENCING
SCOPE OF OUTSOURCING
7
OUTSOURCING SERVICE CENTER
PAPER DRAWINGS (ASSEMBLED COMPONENTS FIGURE) /ELECTRONIC DRAWINGS/3D MODEL
S501
S503
CREATE ELECTRONIC DRAWINGS (TRIHEDRAL FIGURE)
S505
CREATE SOLID FIGURE DRAWINGS (ASSEMBLED COMPONENTS FIGURE)
DEVELOPMENT DRAWING
SOLID FIGURE DRAWING
ATTRIBUTE INFORMATION
S507
REVIEW
BREAK DOWN OF THE ASSEMBLED COMPONENTS FIGURE (PRODUCT→COMPONENT)
VE/VA
FOR A NUMBER OF COMPONENTS
S509
CREATE DEVELOPMENT DRAWING (COMPONENT)
MATERIALS EXPENSES
BLANK PROCESSING EXPENSES
S512
S511
VERIFICATION WITH A PROTOTYPE
BENDING PROCESSING EXPENSES
VE/VA
S513
VERIFICATION WITH ASSEMBLED COMPONENTS FIGURE (COMPONENT→PRODUCT)
WELDING EXPENSES
COATING EXPENSES
ASSEMBLY EXPENSES
S515
EXAMINE MANUFACTURING SCHEDULE
S517
REINVESTIGATE VE/VA
DELIVERY DATE
PRESIDENT
FACTORY MANAGER
EXPERIENCED SHEET METAL BENDING ENGINEER

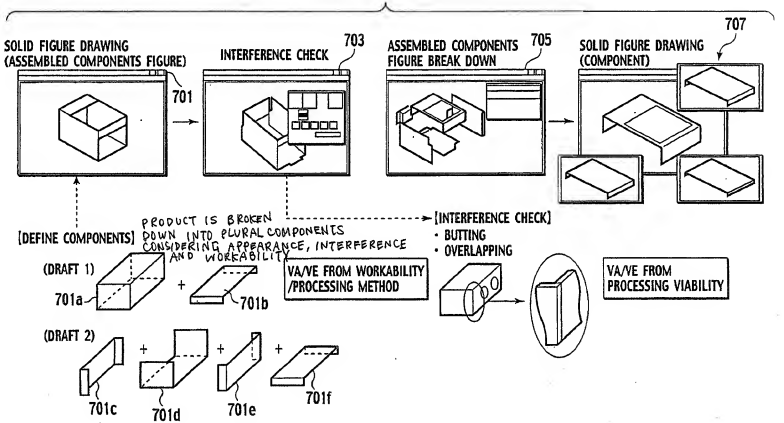
PRODUCE SOLID FIGURE DRAWING FROM DRAWINGS RECEIVED FROM ORDERING CUSTOMER (PAPER DRAWINGS, ELECTRIC DRAWINGS OR 3-D MODEL)

FIG.6



BREAKDOWN OF ASSEMBLED COMPONENTS FIGURE
- BREAKDOWN OF ASSEMBLED COMPONENTS FIGURE IS PERFORMED IN ACCORDANCE WITH INSTRUCTION BY COMPANY PRESIDENT, FACTORY MANAGER AND EXPERIENCED SHEET METAL BENDING ENGINEER

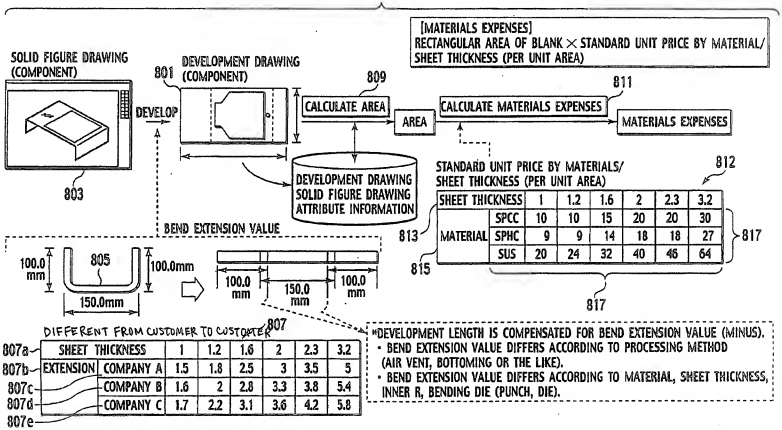
FIG.7



CREATE DEVELOPMENT DRAWING → ESTIMATE MATERIALS EXPENSES

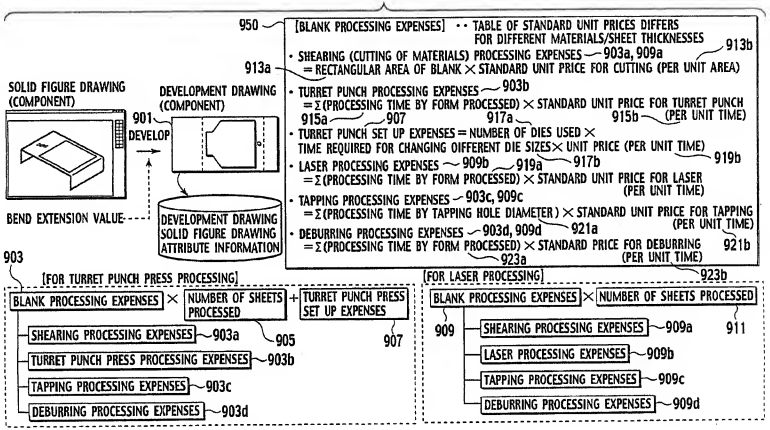
– CREATE DEVELOPMENT DRAWING FROM SOLID FIGURE DRAWING AND CALCULATE MATERIALS EXPENSES FROM MATERIALS (MATERIALS AND SHEET THICKNESS) AND RECTANGULAR AREA

FIG.8



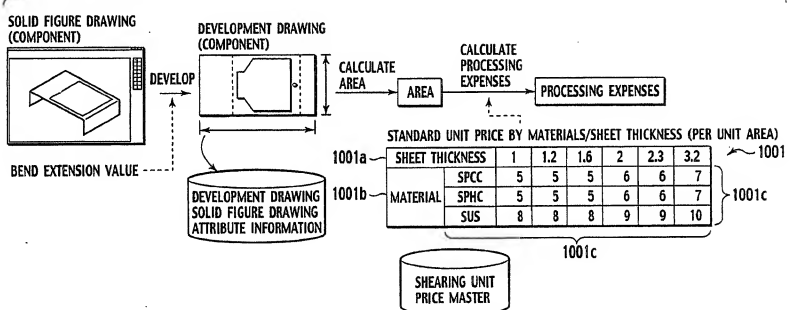
CREATE DEVELOPMENT DRAWING → ESTIMATE BLANK PROCESSING EXPENSES
- CREATE DEVELOPMENT DRAWING FROM SOLID FIGURE DRAWING AND CALCULATE BLANK PROCESSING EXPENSES FROM MATERIALS (MATERIALS AND SHEET THICKNESS) AND FORM DEVELOPED

FIG.9



ESTIMATE SHEARING PROCESSING EXPENSES
- CREATE DEVELOPMENT DRAWING FROM SOLID FIGURE DRAWING AND CALCULATE SHEARING PROCESSES EXPENSES FROM MATERIALS (MATERIALS AND SHEET THICKNESS) AND RECTANGULAR AREA

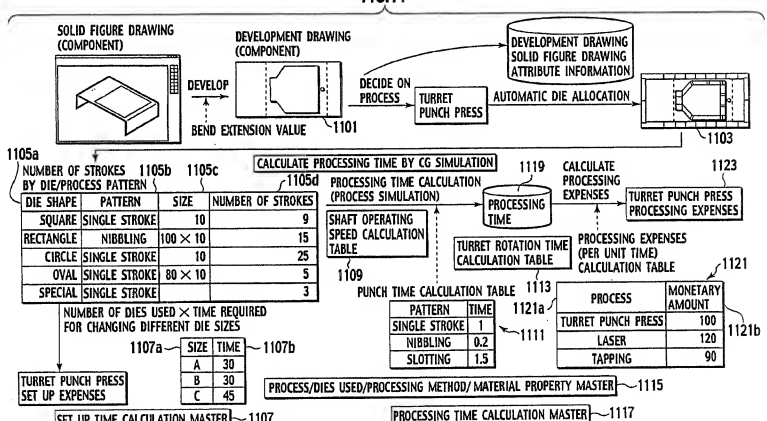
FIG.10



ESTIMATE TURRET PUNCH PRESS PROCESSING EXPENSES

- DECIDE PROCESSING MACHINE FOR DEVELOPMENT DRAWING AND ALLOCATE DIE
- CALCULATE ACCURATE PROCESSING TIME BASED ON PROCESSING SIMULATION
- CALCULATE TURRET PUNCH PRESS PROCESSING EXPENSES BASED ON PROCESSING TIME

FIG.11



DIE SHAPE	PATTERN	SIZE	NUMBER OF STROKES
SQUARE	SINGLE STROKE	10	9
RECTANGLE	NIBBLING	100 × 10	15
CIRCLE	SINGLE STROKE	10	25
OVAL	SINGLE STROKE	80 × 10	5
SPECIAL	SINGLE STROKE		3

PATTERN	TIME
SINGLE STROKE	1
NIBBLING	0.2
SLOTTING	1.5

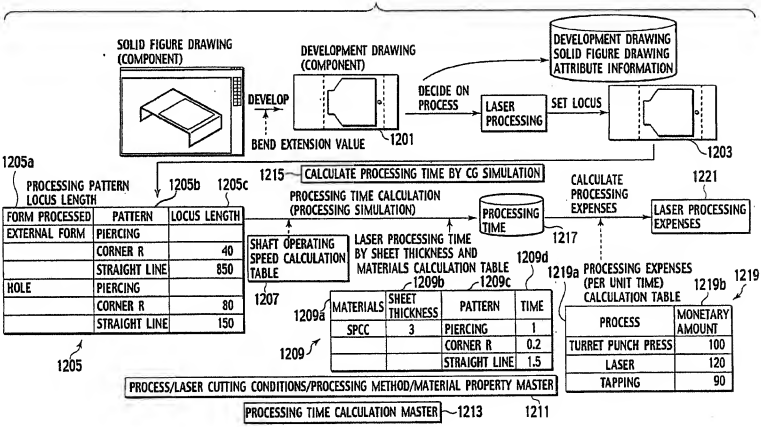
PROCESS	MONETARY AMOUNT
TURRET PUNCH PRESS	100
LASER	120
TAPPING	90

SIZE	TIME
A	30
B	30
C	45

ESTIMATE LASER PROCESSING EXPENSES

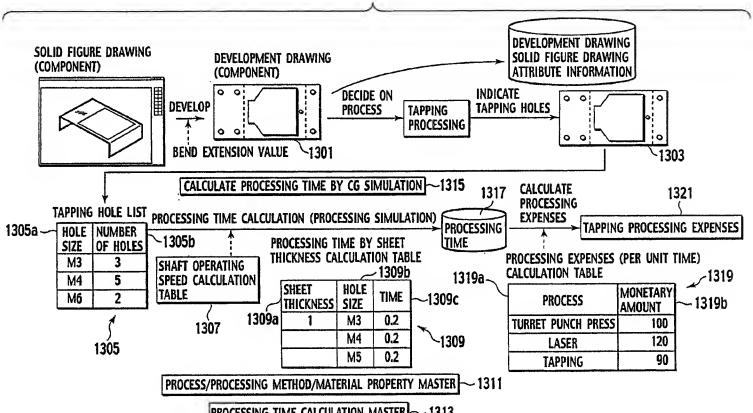
- DECIDE PROCESSING MACHINE FOR DEVELOPMENT DRAWING AND ALLOCATE LASER PROCESSING TRAJECTORY
- CALCULATE ACCURATE PROCESSING TIME BASED ON PROCESSING SIMULATION
- CALCULATE LASER PROCESSING EXPENSES BASED ON PROCESSING TIME

FIG.12



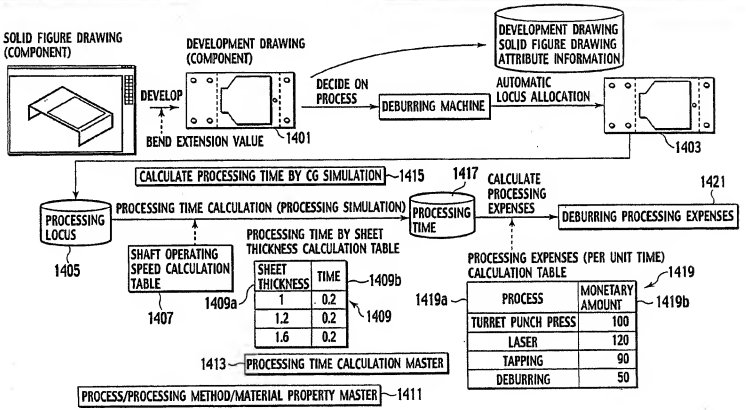
ESTIMATE TAPPING PROCESSING EXPENSES
- DECIDE PROCESSING MACHINE
- CALCULATE PROCESSING TIME BASED ON TAPPING HOLE DIAMETER AND NUMBER OF HOLES
- CALCULATE TAPPING PROCESSING EXPENSES BASED ON PROCESSING TIME

FIG.13



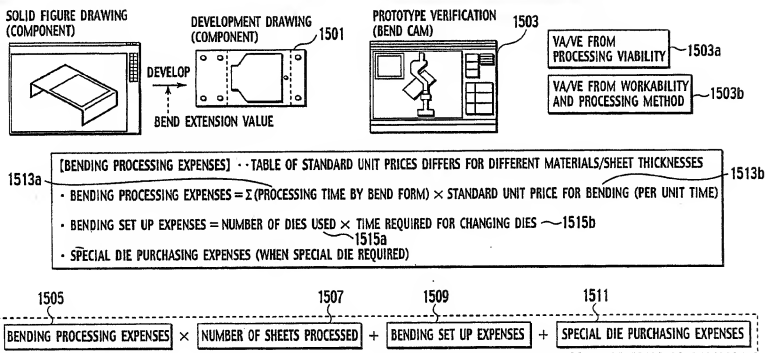
ESTIMATE DEBURRING PROCESS EXPENSES
- DECIDE PROCESSING MACHINE FOR DEVELOPMENT DRAWING AND ALLOCATE DEBURRING PROCESSING TRAJECTORY
- CALCULATE ACCURATE PROCESSING TIME BASED ON PROCESSING SIMULATION
- CALCULATE DEBURRING PROCESS EXPENSES BASED ON PROCESSING TIME

FIG.14



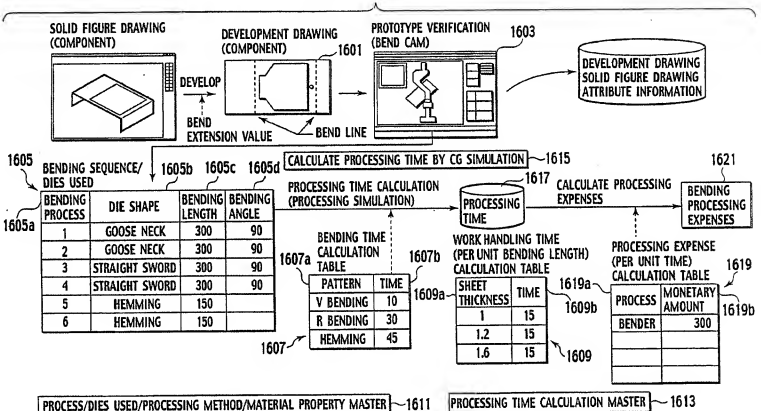
VERIFICATION OF PROTOTYPE → ESTIMATE BENDING PROCESS EXPENSES
- CREATE DEVELOPMENT (COMPONENT) DRAWING FROM SOLID FIGURE DRAWING
- PERFORM BENDING PROESS SIMULATION ON PROTOTYPE TO CALCULATE BENDING PROCESS EXPENSES

FIG.15



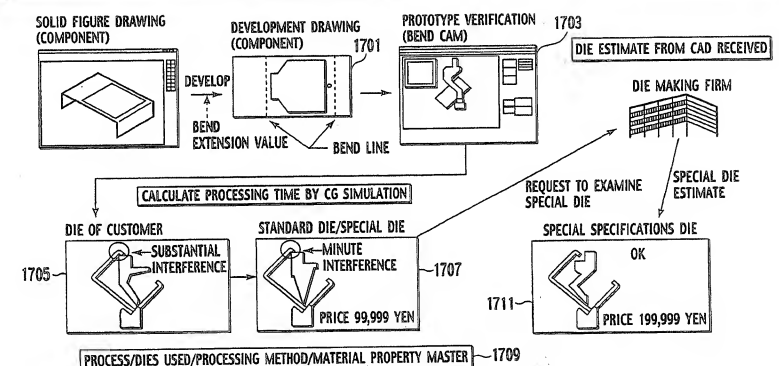
ESTIMATE BENDING PROCESS EXPENSES
- DECIDE BENDING LINE, BENDING ORDER AND DIE TO BE USED USING DR. ABE ETC.
- PERFORM BENDING PROCESS SIMULATION ON PROTOTYPE AND PERFORM PROCESS VERIFICATION TO CALCULATE PROCESSING TIME
- CALCULATE BENDING PROESS EXPENSES BASED ON PROCESSING TIME

FIG.16



ESTIMATE EXPENSES FOR PURCHASE OF SPECIAL DIE
- PERFORM PROCESS SIMULATION ON PROTOTYPE AND CHECK FOR INTERFERENCE
- IF INTERFERENCE ARISE, ADD EXPENSES FOR PURCHASE OF SPECIAL DIE

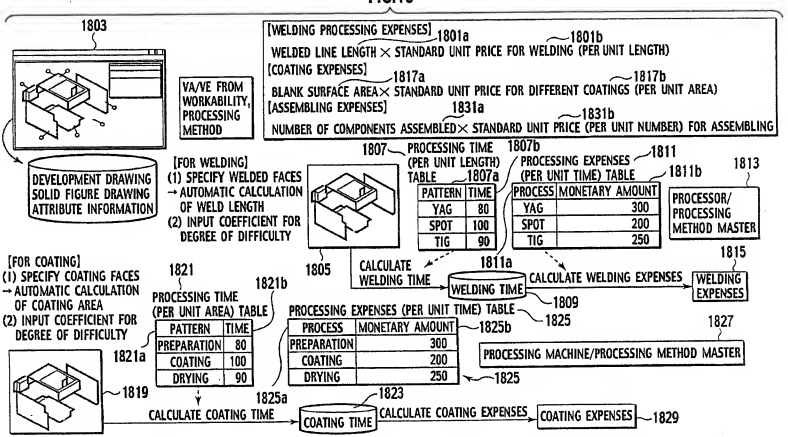
FIG.17



VERIFICATION FROM ASSEMBLED COMPONENTS DRAWING → ESTIMATE WELDING EXPENSES, COATING EXPENSES AND EXPENSES FOR ASSEMBLING COMPONENTS

- PERFORM SIMULATION FOR VERIFICATION FROM ASSEMBLED COMPONENTS DRAWING (COMPONENT → PRODUCT), WELDING PROCESS, COATING PROCESSES AND ASSEMBLING PROCESS AND CALCULATE PROCESSING EXPENSES FOR EACH OF THE PROCESSES

FIG.18



DECIDE DELIVERY SCHDULE
- ACQUIRE PRODUCTION SCHEDULE BASED ON RECEIVED ORDER
- ACCELERATE OR PROLONG THE PRODUCTION SCHDULE BASED ON THE PROCESSING TIME FOR EACH STEPS OF CURRENT ESTIMATED ORDERS
- DECIDE DELIVERY DATES BASED ON DELIVERY DATE OF LAST PROCESSING

FIG.19

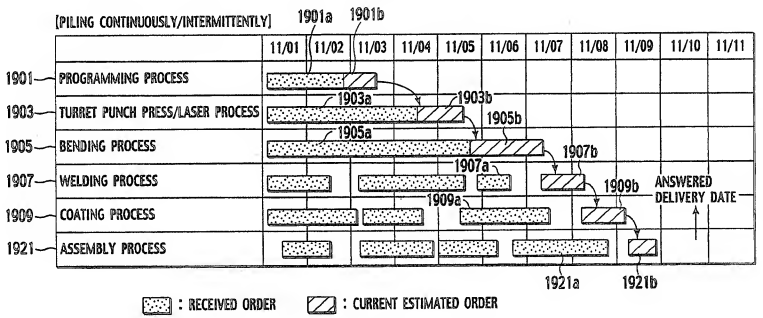
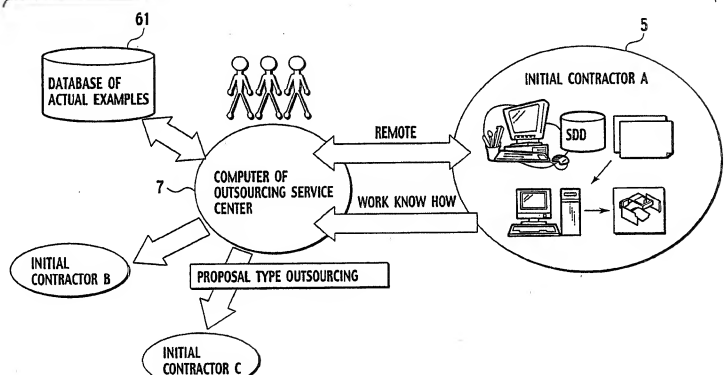


FIG.20


61
DATABASE OF ACTUAL EXAMPLES
5
INITIAL CONTRACTOR A
REMOTE
SDD
7
COMPUTER OF OUTSOURCING SERVICE CENTER
WORK KNOW HOW
INITIAL CONTRACTOR B
PROPOSAL TYPE OUTSOURCING
INITIAL CONTRACTOR C